T301-A

User guide

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Ekahau tags must always be used in compliance with the user environment and instructions contained in the User Manual for the tags.

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1 Introduction

The Ekahau T301-A Wi-Fi tag is part of Ekahau RTLS (Ekahau Real-Time Location System) that consists of the T301-A tag, Ekahau Engine 4.0 (EPE) software platform and Ekahau Finder and Ekahau Tracker end-user applications. The T301-A tags can be attached to any mobile object or asset, and can be carried by people as well. The Ekahau Engine software continuously reports the tag coordinates and logical areas within the Wi-Fi coverage area both indoors and outdoors.

1.1 Software release level

This User Guide documents the functionality available with software release level, 2.1.

1.2 Features of T301-A

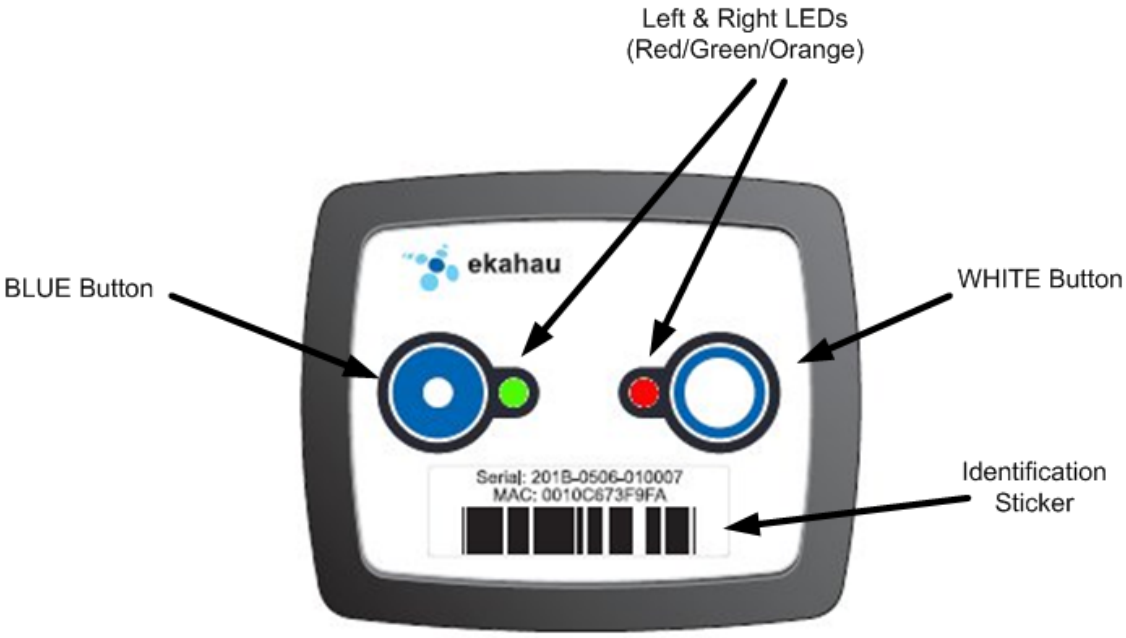
The following features are included with this software release:

- Works with standard 802.11b and 802.11g Wi-Fi networks.
- Support for 64 or 128-bit WEP key authentication.
- Static and dynamic IP addressing.
- Two configurable buttons for switching the tag on and resetting the tag to its factory settings.
- Location reporting triggered by button, periodic timer and motion.
- Two status indication LEDs for determining the tag status.
- Configuration using Ekahau Activator T301-A, standalone tag configuration software.
- Configuration using Ekahau Positioning Engine.

2 Tag operation

2.1 User Interface

Figure 2.1. T301-A user interface.



2.2 Activating the tag

When the tag is delivered it does not have any of the necessary configuration settings. These environment specific settings need to be applied before the tag can connect to the network and the EPE.

Tag activation is done using Ekahau Activator software that configures Ekahau T301-A tags wirelessly. See more information on the Ekahau Activator software in chapter *Ekahau Activator T301 on page 7*.

After successful Activation you will see the MAC address of the tag appears on the EPE list of tags. After successful connection with EPE the configurations can be managed directly from EPE using the T301-A Tag Configurations.

2.3 Status Indication LEDs

The tag is equipped with two multi-color LEDs that provide status indication. The table below lists the different modes of the tag LEDs:

Action	Left LED	Right LED	Status
Periodic or motion activated scan	2xGreen blink	-	Successful scan and results sent to EPE.
Periodic or motion activated scan.	2xRed blink	-	Failed to scan or send results .
Blue button press	1xOrange + 2xGreen blink or 2xRed blink	-	Success - green. Failed to scan or send results - red.
White button press.	2xGreen blink or 2xRed blink	1xOrange	Success - green. Failed to scan or send results - red.
Activation. Blue button 3 seconds.	1xOrange	1xOrange + 6xRed blink + 2xGreen blink or 2xRed blink	Both LEDs blink orange after button press. Right LED blinks during activation. Finally Right LED blinks green or red. Green indicates successful activation.
Reset. Keep white button down until it blinks orange, then press blue button until both LED blink.	1xOrange 1xOrange	- 1xOrange	After completing the sequence erases all configurations from the tag memory.

2.4 Button activated location update and maintenance call

The tag can also be set to scan and update it's location by pressing either of the buttons. After a button press the tag scans immediately and sends the results to EPE, if White button was pressed the TAG will do a maintenance call in addition to the location update . The LEDs indicate the scan success or failure similarly as in the scan activated by the wake up interval.

2.5 Resetting to factory settings

The tag can be reset to factory setting by pressing using a button sequence or by opening the back cover and removing the batteries. To reset the tag using buttons using button sequence do the following:

1. Press and hold the White button until Left LED flashes orange. When the tag is busy this may take even 20 seconds.
2. Then immediately press down the Blue button .

3. After approximately 2 seconds both LED's flash orange.
4. The tag has now been reset to factory settings. The tag is in reset mode when it does not execute button scan as defined in section *Button activated location update and maintenance call on page 4*.

2.6 Firmware update

The tag firmware can be updated wirelessly using EPE. The firmware is uploaded to the Tags from the Tag Properties page in EPE. Follow instruction in the EPE User Guide for updating firmware.

2.7 Optimizing Battery Life

The T301-A Wi-Fi tag uses an ultra-low power system-on-chip architecture that lowers the power consumption to minimal. This enables running tags with same batteries for several years. However, to get the maximum lifetime from your tags you should take care that your network and tag configuration supports all possible power save features.

The principal in optimizing battery life is to determine the maximum interval for location updates, still sufficient for the use case, to minimize the amount of time the tag is active.

Recommendations for optimizing battery lifetime:

- Scan only channels that are in use in your network. Typically, because of overlap of channels, there are only 3 or 4 channels in use from the 11 (or 13/14) available.
- Use single SSID whenever possible. Using multiple SSIDs requires additional network scans and decreases battery lifetime.
- When using dynamic IP addressing tune the DHCP server to provide very long lease times for tags.
- T301-A tag supports roaming between sub networks. This feature renews tag's IP address whenever the access point association changes. Since renewing IP addresses consumes large amounts of energy, it is strongly recommended not to use the network wide dynamic addressing feature if it is not needed.
- Tune the wake up settings to match your application needs. More frequent updates lower the battery lifetime.

3 Ekahau Activator T301

3.1 Installing Ekahau Activator

Note

NOTE! To verify a successful activation Ekahau Positioning Engine is needed. To install Ekahau Positioning Engine refer to the Ekahau Positioning Engine user guide. Normally the Ekahau Positioning Engine is installed together with the Ekahau RTLS installation.

To install Ekahau Activator as a stand alone:

1. Choose a laptop computer with Windows XP, at least 256 MB of memory, PC card slot, and 100 MB of free hard disk space.
2. Install a supported **802.11b/g adapter**, available from corporate IT department or most computer dealers.
   - Make sure the adapter is supported. For list of supported adapters see *Supported Wireless LAN Adapters on page 7*
   - Refer to the adapter's user manual for correct installation
3. Run the Ekahau Activator installer from it's location, and follow the instructions on your screen.

3.2 Supported Wireless LAN Adapters

Ekahau Activator T301 supported adapters are

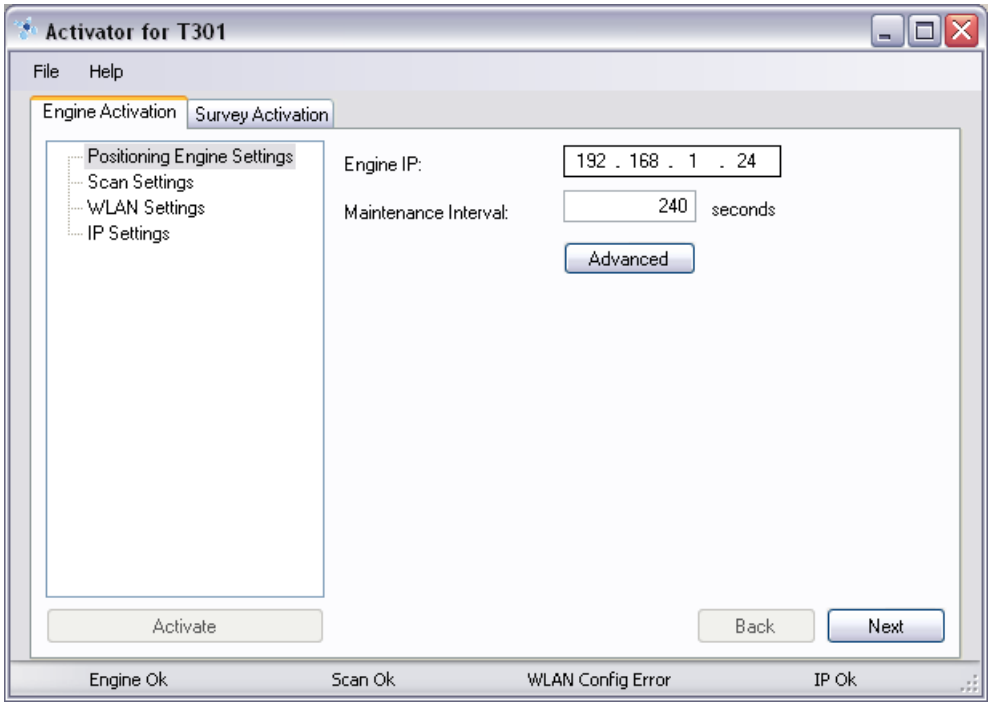
Brand	Model
Ekahau	Ekahau NIC-54
Belkin	F6D3010
Cisco	CB-21AG
D-Link	DWL-AG650
D-Link	DWL-AG660
LANCOM	AirLancer MC-54ag
Linksys	WPC66AG
NEC	Aterm WL54SC
NetGear	WAG511
NetGear	WAG511v2
Nortel Networks	2202
Proxim	Orinoco 8480
SMC	EZ Connect Universal SMC2336W-AG

3.3 Activating T301-A Tags

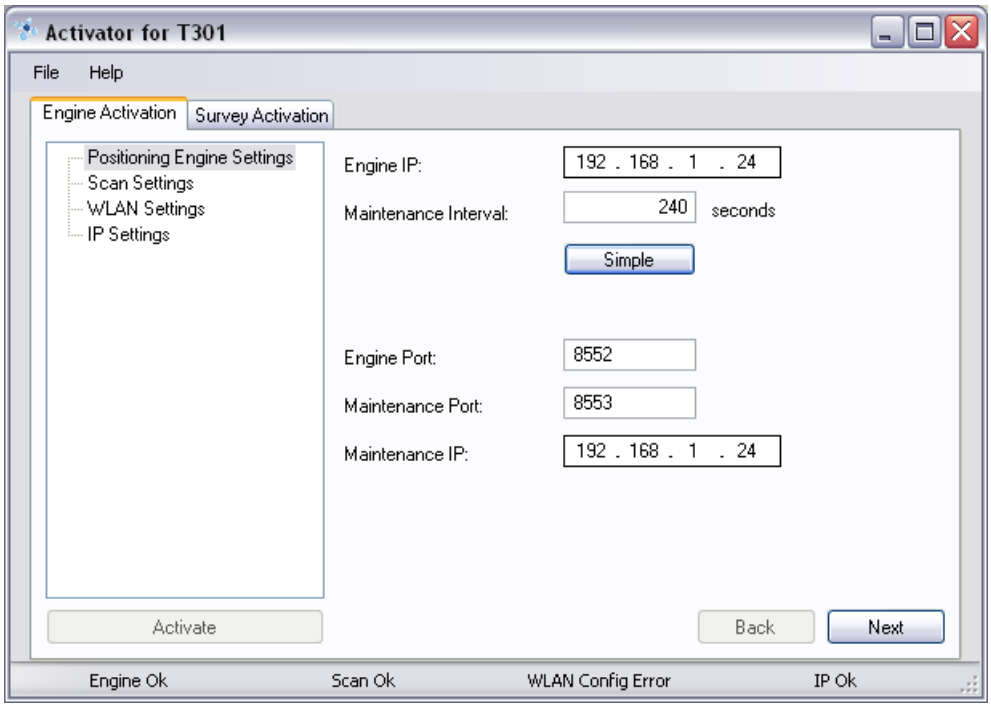
For the tags to be able to communicate with the Ekahau Positioning Engine, the tag needs to be activated e.g. the tag needs to be given the neccesary parameter to associate to the network. At least the IP Address of the Ekahau Positioning Engine, SSID of the network used and the IP configuration method are required. To activate T301-A tags, first start the Ekahau Activator T301. To activate the tags for survey usage please refer to *Ekahau Location Survey User Guide* chapter *Using Ekahau T301 Location Tag*

3.3.1 Positioning Engine settings

Input the IP address of the Ekahau Positioning Engine. After completing the "Positioning engine settings" The status bar should show "Engine Ok". These are the minimum settings needed.



In case Engine Port, Maintenance port or Maintenance IP needs to be changed go to "Advanced" mode.

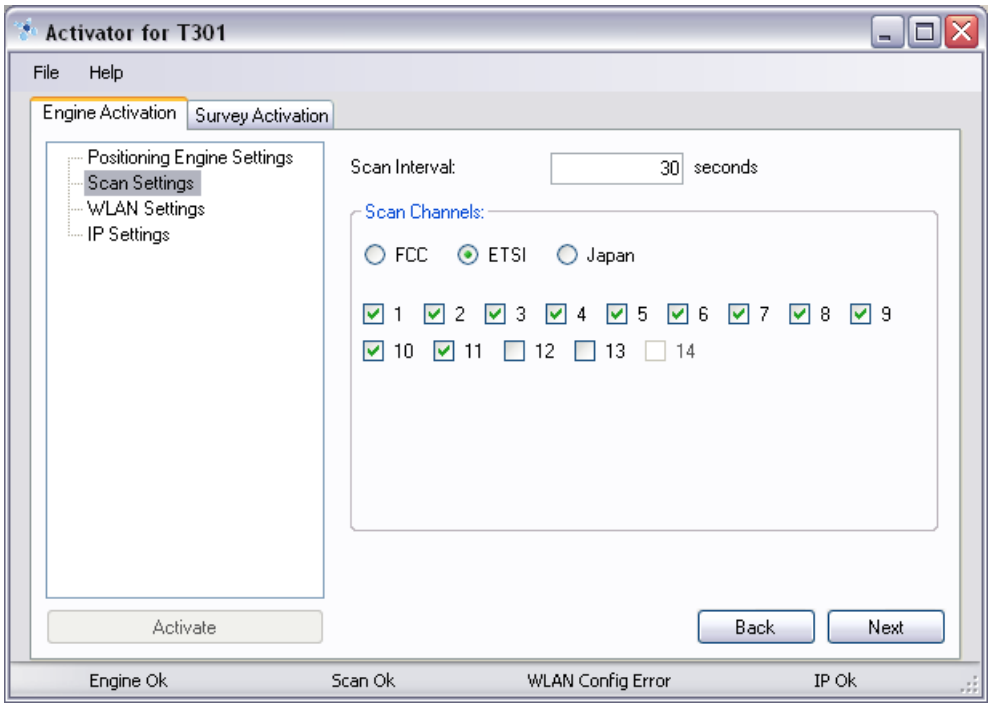


Note

When activating the T301-A tags, only an initial setup is required for the tag to associate with the network. All the settings can be set and changed from the Ekahau Positioning Engine. Ekahau Activator T301 only provides a set of basic settings.

3.3.2 Scan settings

Select the correct area the tag is used in. FCC for North America, ETSI for Europe and Japan for Japan. The software automatically disables the channels not available for the area selected. It is also recommended to only select the channels used in you network. Activating the unused channels will only reduce the battery lifetime of the tag. After completing the settings the status bar should show "Scan Ok"

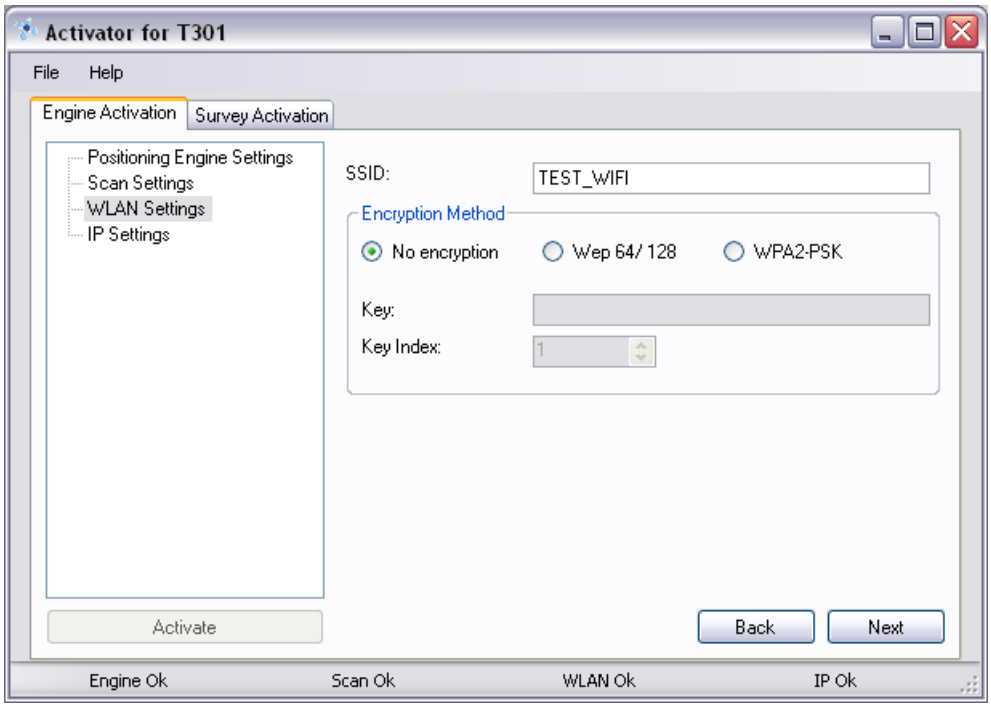


Warning

Only use channels that really exists in you Wi-Fi network. Activating unnecessary channels will reduce the TAG battery lifetime!

3.3.3 WLAN Settings

Input the Network SSID and select the Encryption method used. If Wep 64/128 or WPA2-PSK is used type in the network key. After WLAN settings are completed the status bar should show "WLAN Ok"

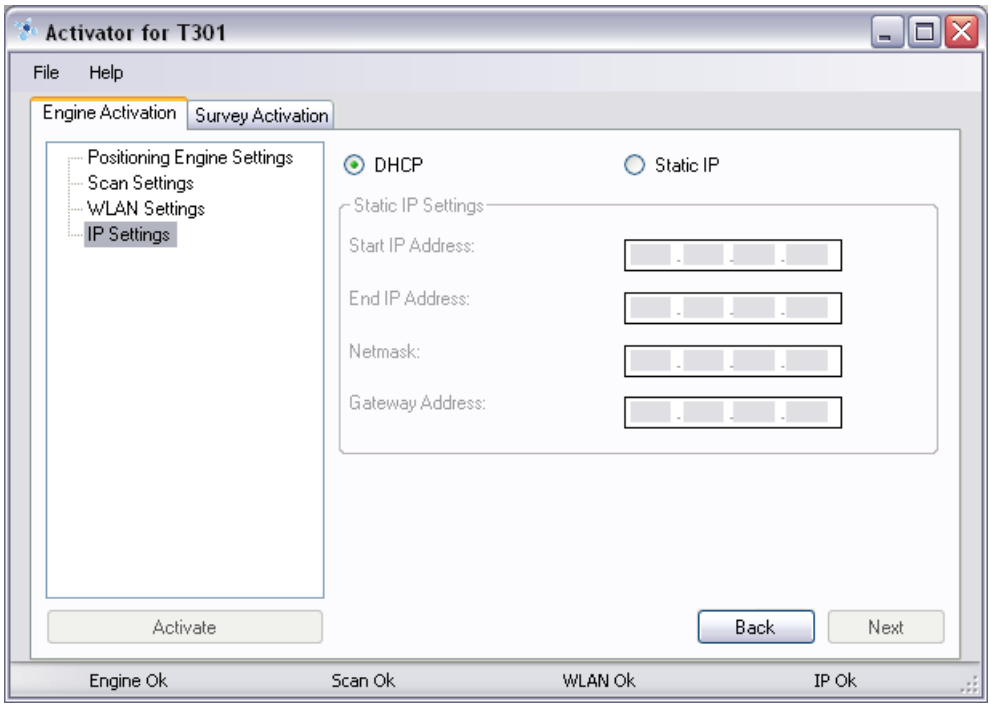


Tip

If Wep encryption is used the Activator automatically determines the key type and length from what you type. Wep 64 require 5 Ascii characters or 10 hex digits, respectively Wep 128 requires 13 Ascii characters or 26 hex digits.

3.3.4 IP Settings

Check the IP settings. If DHCP is used nothing needs to be done. In case your network requires Static IP to be used, type in the IP address range to be used, Netmask and Gateway addresses.



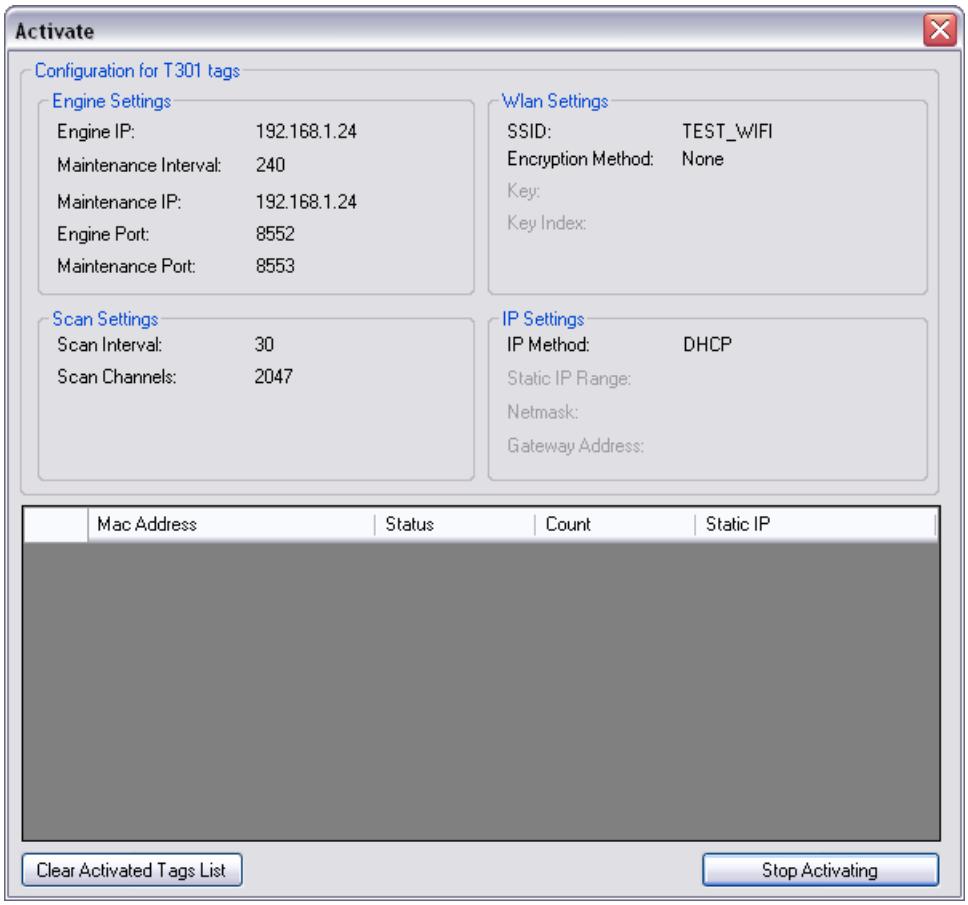
If the supported WLAn adapter is inserted and all the settings are shown Ok in the status bar, the Activate button should now be active. To continue Activating the Tags press the "Activate" BUTTON.

Tip

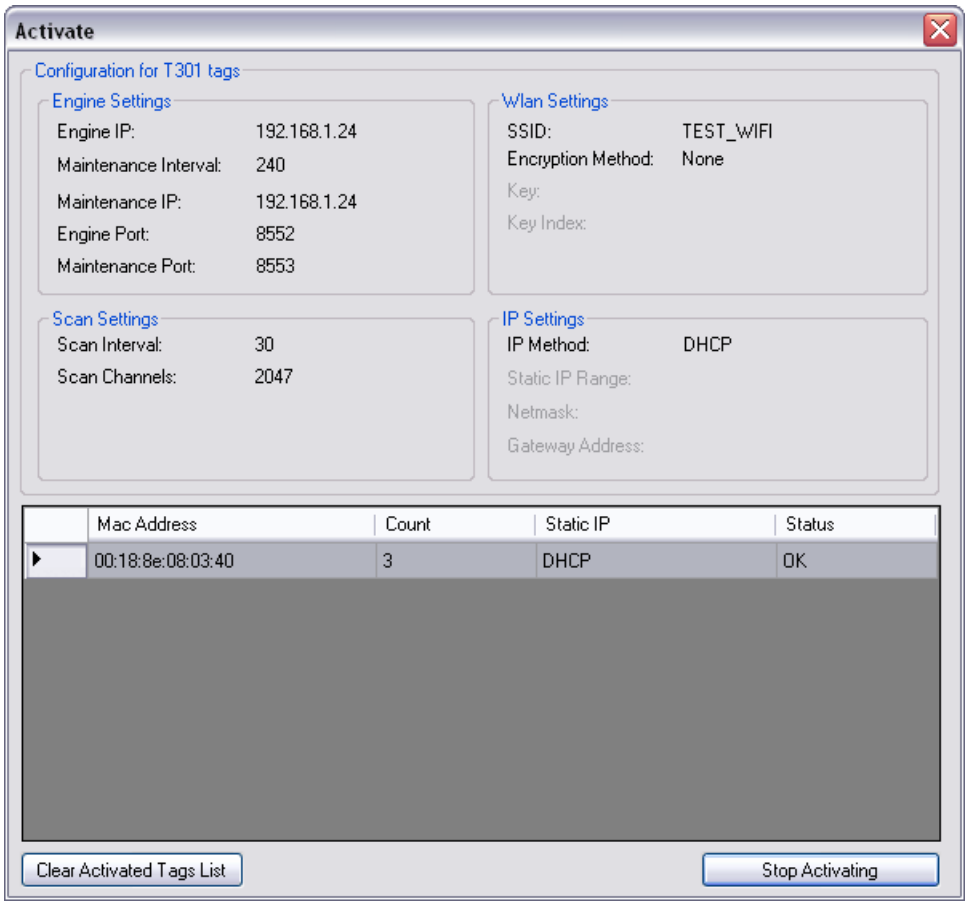
After finished inputting the configuration, you can save it for future use from the file menu. If you save the settings on Ekahau Activator T301.ini the setup will be the default every time the Activator is started.

3.3.5 Activating the tags

The Activation window shows all the settings on the upper side of the window. The list of the activated tags will appead on the area below.



When the activation window appears, the Activator is ready to start activating the tags. Now take a tag and press and hold the Blue button until the Right LED starts blinking. If the activation is successful the white button should stop blinking with 2 green blinks. Also the TAG MAC address appears on the activation window, showing Ok status. Repeat this for all the tags to be activated.



After completing activating the tags, close the activation window.

4 Tag configuration

The tag can be adjusted for each application and network settings by adjusting a set of parameters. The parameters can be changed wirelessly using the Ekahau Activator T301-A laptop software or through Tag Configurations in EPE.

Ekahau Activator is used for configuring the initial configuration settings that allows connecting the tag to EPE over the network. After connection is established with EPE all configurations can be managed through EPE.

4.1 Tag settings in Activator

The list of network settings available in Activator

Setting	Description	Values	Default value
Positioning Engine settings			
Engine IP	IP Address Ekahau Positioning Engine.	IP Address.	0.0.0.0
Engine Port	Port number of location protocol port of EPE.	Port number	8552
Maintenance IP	IP Address of Ekahau Positioning Engine, from where TAG gets the settings. Typically same as the Engine IP	IP Address	0.0.0.0
Maintenance port	Port number of maintenance protocol port of EPE	Port number	8553
Maintenance interval	The interval of the periodic maintenance calls in seconds	0 - 63072000	10
Scan Settings			
Scanning Interval	The interval of the periodic location scans in seconds.	0 - 63072000	10
Scan Channels	Sets the channels that are scanned	Enabled; Disabled	1 - 11 Enabled; 12 - 14 Disabled
WLAN Settings			
SSID	Sets the Wi-Fi network name -*Service set identifier*	SSID=max 32 digits	default
Encryption	Selects if WEP encryption is used	No Encryption; WEP 64/128; WPA2-PSK	No Encryption

Setting	Description	Values	Default value
WEP:	Sets the WEP Pass-phrase	ASCII: 5 or 13 characters HEX: 10 or 26 hexadecimal numbers (0-f)	-
WEP Index:	Sets the WEP index used	1 - 4	1
IP Settings			
IP method	Defines the IP address assigning method.	DHCP; Static	DHCP
Static IP Settings			
Address range	Sets the start and end address of the range used to assign the IP addresses to the tags when Static IP is used	IP address.	0.0.0.0 0.0.0.0
Network mask	Tag netmask when static addressing is used.	IP address	0.0.0.0
IP gateway	IP network gateway when static addressing is used.	IP address	0.0.0.0

4.2 Tag configuration settings in EPE configs page

In Ekahau Positioning Engine it is possible to create configurations to single or multiple tags, after the tags are activated, the configurations are applied to tags from the Tags page. The list of available settings is in the following table

Setting	Description	Values
General		
Name	Name for the configuration set	Free text
Description	Description for the configuration set	Free text
Network		
SSID 1	SSID 1 name, Encryption, Pass-phrase and WEP index.	see *Tag settings in Activator on page 15* for details
SSID 2	SSID 2 name, Encryption, Pass-phrase and WEP index.	see *Tag settings in Activator on page 15* for details
SSID 2 Association	Sets whether tag attempts to associate on SSID 2 network	No Association scan only; Associate and scan
Scan Channels	Sets the channels scanned during a location scan	1- 14

Setting	Description	Values
Broadcast probe	Sets whether the tag uses broadcast probe when scanning	Enabled; Disabled
Tag IP Settings		
IP Setting	Sets the IP method used	DHCP; Network wide DHCP (See NOTE 1); Preserve the IP set in activation
Positioning Engine		
IP Address	Sets the EPE IP Address	IP Address
Location update Port (UDP)	Port number of location protocol port of EPE.	Port number
Maintenance interval	The interval of the periodic maintenance calls in seconds	The interval in Seconds, Minutes, Hours or Days
Maintenance port	Port number of maintenance protocol port of EPE	Port number
Periodic location update		
Periodic Wake up	Enables or disables the periodic location update	Enabled; Disabled
Interval	Sets the interval for the periodic location update	The interval in Seconds, Minutes, Hours or Days
Motion Sensor		
Motion Sensitivity	Enables and sets the sensitivity for the motion sensing	Disabled; Enabled with profiles from 1 to 4
Motion Update Method	Sets whether location updates are sent periodically during the motion or just when the motion starts and after the movement has ended.	In-motion and after motion; After motion
Motion Update Interval	Sets the interval for motion updates	10s, 30s, 1min, 2min, 5min
Tamper sensor		
Tamper sensor	Enables and disables the tamper sensor (see NOTE 2 and NOTE 3)	Enabled; Disabled

Note

1) Network wide DHCP enables roaming between sub networks. With this setting the tag refreshes its IP address whenever the tag associates with a new access point. It is not recommended to use the feature, if not required, due to higher power consumption

Note

2) The Motion sensor must be enabled for the Tamper sensor to work. The tamper sensor is read when motion is detected

Note

3) The Tamper sensor is an optical sensor that measures the distance from the sensor to the surface the tag is attached to. Due to sensors optical nature the surface material and texture has an affect on the sensor reading. Therefore the sensor needs to be calibrated when the tag is attached. The sensor is calibrated when enabled, so first attach the tag and only after that enable the tamper sensor. If the tag needs to be re-located, shortly disable the tamper and enable again after relocated the tag.

4.3 Tag actions available in Ekahau Positioning Engine Tags properties page

Setting	Description	Values
Commands		
LED / Buzzer	Launches the alarm at the tag with LEDs and buzzer of silently with LEDs only. The alarm duration can be set.	LED; LED and Buzzer Duration: 10s; 1min; 10min; 30min; 1h; 2h
Request info	Not used for T301A TAG	-
Manual Commands	Manual command or a list of commands can be sent to a tag.	-
Set Config	A pre defined config can be selected and sent to tag(s)	A list of available configs
Firmware Update		
Firmware	Tag firmware can be updated. The new firmware needs to be first uploaded in the configs page	A list of available firmware updates uploaded in EPE
Manual IP Settings		
Manual IP address	Sets the tag IP Address	IP Address
Netmask	Sets the tag netmask	IP Address
Gateway	Sets the default gateway for the tag	IP Address

5 Technical specifications

5.1 General

- Outside Dimensions (mm): 45 x 55 x 19
- Weight: 1.7 oz / 48 g with batteries
- Power: 2xCR2 3.0V Lithium (LiMnO2) batteries
- Two buttons with call button functionality
- Two red/green/orange status indication LEDs
- Operating Temperature: 32 to 122ºF / 0 to 50 ºC, battery lifetime is lower on the low and high end of the temperature range.
- Storage Temperature: -40 to 140ºF / -40 to 60 ºC, battery lifetime is lower on the low and high end of the range. Storage in room temperature is recommended.
- Humidity: From 20% to 95 % non-condensing, relative humidity
- Environmental Protection: protected against dust and spraying water

5.2 Wi-Fi

- Supported IEEE Standards: 802.11b/g
- Modulation Scheme: Direct Sequence Spread Spectrum (DSSS)
- Media Access: CSMA/CA
- Transmit Power: +11.5dBm@2Mbps
- Receiver Sensitivity: -82dBm@11Mbps
- Frequency Ranges:
  - 2.400 - 2.4835 GHz (USA, Canada, Europe)
  - 2.400 – 2.497 GHz (Japan)
- Supported Networking Protocols: UDP/IP, DHCP or static addressing
- Security: WEP Encryption 40/104 Bit
- Antenna Type: 2 x Internal omni-directional ceramic multilayer, antenna diversity
- Maximum Antenna Gain: +1.5 dBi

5.3 Operating Ranges from an Access Point

- Open Space: 60m (180ft)
- Typical Office: 30m (90ft)

5.4 Battery replacement

Figure 5.1. Battery polarity and replacement

Warning

A minimum of 1 minute waiting period must take place between removing the old batteries and inserting the new ones!!! Always remove both batteries at once.

Batteries are replaced by opening the four screws on the backside of the tag. Old batteries maybe removed from the device by pulling them gently upwards. After removing old batteries a 1 minute waiting period must happen before inserting new batteries. New batteries should be placed between the battery springs. Check that the polarity of the batteries is correct. There are battery polarity indicators on the circuit board and inner surface of the front cover. The correct polarity is also showed in photo above. Avoid touching the circuit board and the flex cable when replacing batteries as they may become damaged from static electricity or mechanical impact.

Recommendations for choosing and replacing batteries:

- Use always new batteries.
- Replace both batteries at the same time.
- Use only 3.0V, CR2 size batteries.
- Ekahau recommends batteries from Duracell, Maxell, Sanyo or Varta.

After batteries have been replaced close the back cover, replace and tighten the screws.

5.5 Care and Maintenance

- Keep the tag dry. Precipitation, humidity and all types of liquids or moisture can contain minerals that will corrode electronic circuits.
- Do not use or store the tag in dusty, dirty areas. Its moving parts can be damaged.
- Do not store the tag in hot areas. High temperatures can shorten the life of electronic devices, damage batteries, and warp or melt certain plastics.
- Do not store the tag in cold areas. When it warms up (to its normal temperature), moisture can form inside, which may damage electronic circuit boards.
- The operating temperature of the tag is 0 to 50 ºC. Do not operate the tag outside this temperature range.
- Open the tag only for replacing batteries.
- Do not drop, knock or shake the tag. Rough handling can break internal circuit boards.
- Do not use harsh chemicals, cleaning solvents, or strong detergents to clean the tag.
- Do not paint the tag. Paint can clog the moving parts, affect the radio communication and prevent proper operation.
- Use a soft, clean and dry cloth to clean the tag.
- Use only the supplied antenna. Unauthorized antennas, modifications or attachments could damage the tag and may violate regulations governing radio devices.

6 Certifications

6.1 FCC Rules

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

(1) this device may not cause harmful interference, and

(2) this device must accept any interference received, including interference that may cause undesired operation.

FCC ID of this device is:TA7-T301-A1

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

6.2 CE Marking

This device has been tested to meet the Electromagnetic Compatibility (EMC) requirements of EN50082-1 and EN50022 for the CE Declaration of Conformity (DoC).

7 Limited warranty

Ekahau warrants that the Tags will operate in accordance with and substantially conform to their published specifications when shipped or otherwise delivered to the end user and for a period of 1 year thereafter, provided, however, that Ekahau does not warrant any claim or damage under this Warranty if such claim or damage results from:

1. Misuse, neglect, accident or improper installation or maintenance of the Tags,
2. Tags that have been altered, modified, repaired or tampered with by anyone other than Ekahau,
3. Use of the Tags not in compliance with their respective documentation, user manuals, instructions, and any usage restrictions contained therein, including, but not limited to, the provisions relating to the environment and ranges where the tags must be used, or
4. Accident, fire, power failure, power surge, or other hazard.

Otherwise, the Tags are sold AS IS. In no event does Ekahau warrant that the Tags are error free or that end user will be able to operate the Tags without problems or interruptions.

End User is responsible for using the Tags within their specifications as contained in the Documentation.